

REPORT DOCUMENTATION PAGE

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MEMORANDUM FOR PRS (In-House Publication)

FROM: PROI (STINFO)

15 August 2001

SUBJECT: Authorization for Release of Technical Information, Control Number: **AFRL-PR-ED-AB-2001-172**
David Barland, "Orthotropic Mechanical Properties of Uncoated and Ceramic-Coated Uniaxially-Compressed Carbon Cellular Porous Materials"

43rd AIAA/ASME/ASCE/AHS Struct., Struct. Dyn. & Materials Conf.
(Denver, CO, 22-25 April 2002) (Deadline: 21 Aug 01)

(Statement A)

1. This request has been reviewed by the Foreign Disclosure Office for: a.) appropriateness of distribution statement, b.) military/national critical technology, c.) export controls or distribution restrictions, d.) appropriateness for release to a foreign nation, and e.) technical sensitivity and/or economic sensitivity.

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PHILIP A. KESSEL
Technical Advisor
Space and Missile Propulsion Division

Date

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Orthotropic Mechanical Properties of Uncoated and Ceramic-Coated Uniaxially-Compressed Carbon Cellular Porous Materials

Abstract

Porous cellular foams of moderate to high porosity (55%-95%) were investigated to determine orthotropic strength moduli and mechanical response. Uncoated porous samples consisted of reticulated vitreous carbon (RVC) rigidized by pyrolysis of flexible, open-pore organic precursor foams. The organic precursor's reference surface pore density was 100 pores-per-inch (ppi) before uniaxial compression. After compression, substrates contained 6% to 33% solid fraction, which corresponded in the thru-thickness direction to 200 ppi to 1100 ppi, respectively. Ceramic-overlaid samples were constructed by depositing silicon carbide (SiC) via chemical vapor infiltration (CVI) onto 600 ppi and 1000 ppi RVC substrates. The ceramic overlays added solid fractions of 5% and 12%, respectively. Compressive and tensile strengths were measured in-plane and thru-thickness for all materials. Results showed compressive crush strengths of the multi-layer porous materials to be bounded between theoretical strengths of solid RVC substrate and SiC-coated materials. Predictions from currently accepted cell anisotropy relations were compared to experiment and are shown to greatly over-predict the orthotropy due to uniaxial compression. The data may be applied to allow more precise design of components using ceramic-coated porous cellular materials.